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**Taking the consequences of international conventions, national policy and our own arguments: developing the way of working at the Institute of Marine Research, Norway, to deliver according to the ecosystem approach.**

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Over the years The Institute of Marine Research, has been developed to become the leading body for monitoring and exploration of marine ecosystems, development of the aquaculture industry, and science based advices on harvesting of living marine resources in Norway. The institute developed with a steadily growing classical hierarchical organization with departments according to scientific disciplines or ecosystem categories. During the nineties the institute operated with scientific centres on aquaculture, living resources, and marine environment, and received a rather favourable evaluation by an international panel in 2001.

Instead of continuing on a recognized way of functioning, a process was started to develop the organization of the institute to be better able to deliver science based advices according to the ecosystem approach. A matrix organization with four research and advisory programmes, 19 research groups, a research technical department with eight sub-units, a central administration and a research vessel department was implemented in 2004. Recently, the organizations is adjusted and developed even further so that we now have 10 programs, five of them a research and advisory profile, the others a clear thematic profile. The research and technical groups have been integrated to get a better cooperation and social interaction between the scientific and technical employees.

We analyse how these structural changes have influenced the scientific production, the advisory activity, the “working environment” and the well being of the employees of the institute.

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## **Introduction**

The ecosystem approach (Fig. 1) to fisheries management and ocean governance now requested by management bodies worldwide represents a major challenge for marine research institutes that is based on national mandates to advice on the state of marine ecosystems and the harvest of living marine resources. The ecosystem approach is a holistic concept, but the procedures for assessment and management of fisheries within this concept is not defined explicitly. The FAO Expert Consultation on Ecosystem-based Fisheries management in Reykjavik in 2001 (Anon, 2002a) produced an overall, pragmatic solution for implementing the ecosystem approach to fisheries (EAF) incrementally by merging ecosystem management and fisheries management, but the practical application of these EAF principles are yet to be implemented in most of the fisheries scientific and advisory bodies around the world. These institutions can adjust tactically towards the ecosystem approach by gradual extension of the science and assessment procedures. A more drastic solution will be to incorporate the ecosystem approach strategically. For conventional marine research and advisory institutes that is organised with research centres, scientific departments and a suite of thematic research programmes in a matrix structure, such a solution will in many cases require a complete restructuring of the whole organization. Bianchi (2007) argue that present sectoral institutional arrangement found in many countries is not adequate for a holistic approach to management of ecosystems.

Internationally, an ecosystem approach was decided for the further management of the North Sea environment as decided by The Fifth International Conference on the Protection of the North Sea held in Bergen in 2002 (Anon, 2002b), and it is a central element in the strategic plan of the International Council for the Exploration of the Sea adopted in Copenhagen in 2002 (Anon, 2000a). At a national level, the Norwegian Parliament adopted the ecosystem approach as the central principle for management of the ocean environment in Norwegian waters in 2002 (Anon. 2002c). At an institutional level, an internal committee discussed how our scientific and advisory activities could be developed to take account of the ecosystem approach (Anon, 2001a). Partly as a strategic solution to incorporate the ecosystem approach, the Board of the Institute of Marine Research (IMR), Norway, decided in spring 2002 to restructure the institute (Fig. 2). In the following, we describe the restructuring process and the new organization that have been developed.

## **On the history and development of IMR**

IMR, Norway was founded in 1900 (Schwach, 2000), and is now one of the largest marine research and management advisory institutes in Europe (Fig. 3). There are about 700 employees on the pay roll, 4 research vessels (28 – 78 m long), and in addition the management and operation of a research vessel (55 m long) in African waters. Further, a large number of fishing vessels are being chartered on short term contracts for specific operations annually. There are two aquaculture field stations located in Austevoll and Matre, both within two hours travel from Bergen. In addition, there are experimental facilities and specific laboratories on the premises in Bergen and Arendal.

During its more than one hundred years of history the institute have developed generically (Schwach, 2000). There was a structuring of the institute in the early seventies following the recommendations of the Mosby Committee (Anon, 1969), and a further restructuring of the institute in the early nineties based on the recommendations from the Vartdal Committee (Anon, 1987). During the later process, the institute became an independent body under the Royal Norwegian Ministry of Fisheries. The growth of the institute has been based on the principle of building an organization by departments divided according to scientific disciplines. In 1992, the altogether 14 scientific departments were sorted under centres of living marine resources, of marine environment and aquaculture. A centre for coastal zone activities was established in 2002.

Both some of the thematic research programmes and the institute itself has been evaluated in later years by international committees appointed by The Research Council of Norway. The thematic programmes received fairly good comments (working from fair to very good), both on the scientific achievements and production (Anon, 2000b). Likewise the comments on the institute itself were generally very positive (Anon, 2001b), being highlighted as a well-run organization at a reasonably high standard internationally. Around the year 2000, the activity of the institute resulted in a production of about one scientific paper in an internationally referred journal pr. scientist pr. year. In addition, extensive line programmes with surveying and monitoring of the marine environment and living marine resources as the basis for quality assured assessment and management advices were carried out annually.

Despite the well-functioning of the institute, there was a growing realization that the research centres became more and more like four independent bodies within the institute. The centres were managed as separate units economically and partly administratively, and there were fairly little cooperation and interaction between them. To integrate the institute, and rebuild a united institutional organization and “culture” (Steen Jensen, 2002), a reorganization process seemed necessary.

### **Process of reorganization**

Following the formal decision by the Board, a set of internal committee’s was appointed to evaluate the existing structure of the institute. These evaluations were summarized by an internal committee that was given the mandate to suggest a principle draft for a new organization. This resulted in a conceptual draft based on ecosystem oriented, management advisory programmes and a thematic programme for aquaculture. A set of research groups was suggested to carry out scientific, monitoring, assessments and advisory projects requested by the programmes. To integrate the institute, the research directors responsible of the programme deliveries, should constitute an executive team of leaders together with the managing director (Garratt, 2003). To envisage the integration three of the research directors and the managing director moved to adjacent offices in the headquarters in Bergen.

A conceptual draft for a new organization was adopted by the Board and the Royal Norwegian Ministry of Fisheries in autumn 2002. To lead the further development of the new organization, a “core” group with the research and administrative leaders and representatives of the employee’s unions under the leadership of the managing director was appointed. This was done to involve all units in the institute in the reorganization process (Kotter, 2000). The “core” group decided to take lead in the reorganization without involvement of external consultants, rather agreeing that it was now up to all the employees to get involved to secure a creative process and a good result.

During autumn 2002 and winter 2003 the research groups were being developed. The Board finally decided on 19 research groups and the continuation of a Centre for development cooperation, spring 2003. Three of the research groups were given a fish stock and ecosystem

responsibility, the sixteen other groups were given a thematic objective. The two groups that were given a fish stock and oceanic ecosystem responsibility should have either a top down or a bottom up approach to facilitate development of operational ecosystem model concepts (Svendsen et al, 2002). The scientists and scholarships were offered a volunteer procedure prioritizing three research groups to join. 189 out of 192 scientists and scholarships delivered a complete form, and 161 of them were given their first choice. Most of the other agreed to accept the second or third alternative to realize the new organization. The positions as research group leaders were advertised internally spring 2003, and the positions filled before the summer holidays 2003.

To develop a rational structure, a Department of Research Support was established to organize most of the technical competence as a united service. This department were divided in 9 research technician groups. The research technicians were offered a similar volunteer procedure as the scientists for which research technician groups to be a member of. By early autumn 2003, it became clear that 75 % of the about 150 research technicians prioritised membership of a research group. To realize the new organization it was agreed in the “core” group that only 25 % of the research technicians could be members of research groups. Following an internal process of conversations with the individual employee, the positions of the research technicians was agreed upon, late autumn 2003. The positions as research technician group leaders were advertised internally, and the posts filled late autumn 2003. The administrative employees in each of the research centres were incorporated in the administration unit following a similar volunteer process as for the other employees.

### **The new organization: Research and research technicians groups.**

The scientific activity was organized through projects carried out by research and research technician groups. The nineteen research groups organized from 6 to about 30 persons. A few of the larger groups had up to five technicians together with the scientists. The divisions between the research and research technician groups were made specifically to secure interaction among the groups. This was because the research groups should ask for involvement and services from the research technician groups to be able to carry out their projects. The research technician groups on the other hand, were given the responsibility to make the scientific infrastructure (laboratories on land and onboard the vessels, facilities on the research stations, and the data centre) available and functionally for the research groups.

To secure cooperation and interaction among the research groups, larger integrated projects involving scientists from different groups were attempted coordinated by the Management advice and research program. Such projects could also be initiated by the groups themselves as long as they were in accordance with the overall research strategy of the institute.

### **The new organization: Management advice and Research Programs**

In the development of the new organization there were other underlying principles than in the earlier structures. While the former research centres gave management advices within their scientific domain independent of geography, the management advices were now channelled through four programs. The three ecosystem-based and one thematic programs should structure the scientific and management advisory activity of IMR (Fig. 4). Within these programs, all the activities were defined into projects that were ordered and carried out by the research and research technical groups. The science and management advisory tasks requested by the Ministry of Fisheries and Coastal Affairs were defined as projects with allocated funding by the programs. Scientific projects achieved from the Norwegian Research Council, from the framework programs of the European Commission, or from other sources are also defined as projects within the respective programs. Each program was the responsibility of one of the research directors, and a coordinator assists the management of each program. The three ecosystem based programs were set up according to the division of large marine ecosystems (LMEs) in the North Eastern Atlantic (Sherman 1995, Sherman & Skjoldal 2002). There was one program that covers the Barents Sea LME and one that covers the Norwegian Sea and the North Sea LMEs together. A third program covered the coastal zone of Norway. The fourth program was thematic and covered the aquaculture activities of the institute.

The ecosystem programs builds on a common, simplified understanding of the ecosystem approach to focus on three main themes:

- 1) A clean sea (monitoring and advices to secure a lowest possible level of contamination of anthropogenic pollutants in the marine environment and seafood)
- 2) Better advices for sustainable harvest of marine resources (single species models will still be applied, but multi-species considerations and ecosystem information will be taken more account of)

### 3) Reduced ecosystem effects of fishing (improve size and species selection of fishing gears and lower the impact on bottom fauna)

Parts of the Barents, Norwegian and North Seas LMEs are within Norwegian jurisdiction, and Norway has the right to harvest the living marine resources within these ecosystems together with other coastal states. International cooperation at the scientific and management levels is therefore important for effective implementation of an ecosystem approach. The natural and anthropogenic drivers that influence the ecosystem structure, productivity and major living resources within these LMEs are different. Reflecting the differences in political and ecological contexts, the science and advisory programs have taken somewhat different approaches in building up their project portfolios.

The Barents Sea program focused on projects that document the environmental quality of the sea water (“clean sea”), projects to survey and assess the state of marine mammals and commercial fish stocks where environmental and multispecies considerations were taken into account if relevant relationships exist, and finally on projects to reduce the impact of fishing and other anthropogenic influences on the ecosystem. A special responsibility of the program was to coordinate the surveys, assessment and advisory activities with Russian interests through cooperation with PINRO in Murmansk, and to take part in the Norwegian – Russian Fisheries Commission that on a political level allocates the TAC of the fish resources in the Barents Sea.

The science and advisory program for the Norwegian Sea and the North Sea LMEs focused on projects to monitor, survey and assess the ecosystem conditions, including anthropogenic impact on the ecosystem, and on specific projects to provide new knowledge about the ecosystem structure and functioning, and management of the human activities within these ecosystems. The program coordinated the survey, assessment and advisory activities with other coastal states (the EU, the Faroes, Iceland, and Russia in the Norwegian Sea, and the EU in the North Sea) under the auspices of ICES.

The science and advisory program for the coastal zone of Norway focused on coastal ecosystems and method development for coastal zone studies, including investigations of biodiversity and living marine resources in the coastal zone. The biodiversity development

was studied in selected reference areas along the coast. The program assisted local, regional and national authorities in development of an integrated coastal zone management.

The thematic aquaculture program concentrated on providing knowledge for a responsible and sustainable development of Norwegian aquaculture. This included knowledge for development of aquaculture of new marine species like cod, haddock, halibut, scallops, and blue mussels, and research on fish welfare and production of safe and high quality food from aquaculture.

## **Implementation**

The new organization was implemented January 1<sup>st</sup> 2004 (Fig. 2). Then, the employees within the scientific parts of the institute all had to find their place within the new research and research technician groups. The scientific activity was run through specific projects formulated by the management advice programs. The research directors should function as a coordinated team, but each of them with a specific responsibility for one of the management advice programs. Altogether, this was probably one of the largest changes in the way of working and functioning within the institute ever.

A substantial effort to work and deliver as attempted under the new organization was made by the employees. The scientific and advisory production went on much as before. But during 2004 and 2005 there were clear signals that the new organisation had severe difficulties. The organisational separation between the scientific and technical staff caused a reduction in the scientific and social communication within the institute that was felt as a great loss among many employees. A measurement of the working and social atmosphere spring 2005 by an external consultant gave clear signals of substantial discomfort within certain parts of the institute and with the internal communication of the institute. Administratively, budgeting of the programs and projects was a too cumbersome process with too much internal competition. It was also realized that there were established too many projects, in fact many of the projects were just administrative units to follow up contracts or tasks. During autumn 2005, discussions and suggestions on how to improve the functioning of the institute were assisted by consultants from the Administrative Science Foundation (AFF) in Bergen.



The dissatisfaction with the new organization culminated at a seminar lead by consultants from AFF for the whole institute in Bergen January 6<sup>th</sup> 2006 (Fig. 2), from which there came a clear signal of a change towards a better way of functioning of the institute. Especially, the organisational division between the scientific and most of the technical staff caused negative feelings. A clear need for a better internal communication was also noticed.

## **Adjustment**

Following the January 2006 seminar, a “road ahead” group was established to propose a further development of the organisation of the institute. The group was chaired by the managing director and with appointed members from the leaders, the unions, the research and research technical groups. The group used much time to agree on the main internal and external challenges, and on this basis to develop the necessary adjustment of the organisation. Through a rather intense process, a proposal for a further development of the institute was presented to the Board in August 2006. A final decision for the further organisation of the institute was made by the Board in September 2006.

The new organization continued the main elements of the 2004 organization with programmes and research groups. The main elements of the new organisation were 10 programmes of which the Barents Sea Ecosystem, The Norwegian Sea Ecosystem, the North Sea Ecosystem, the Coastal Zone Ecosystem and the Aquaculture programmes had a combined management and science responsibility, while the Climate –Fish, the Oil – Fish, the Ecosystem and Population Dynamics, the Biological Mechanisms, and the Mareano (sea bottom and habitat mapping) programmes had a scientific theme focus (Fig. 5).

As from the 2004 organization, all scientific and advisory activity of the institute should be structured through projects established by the 10 programmes. To strengthen the project awareness within the institute, a special activity to define and outline the basic procedure for project realization within the institute was run in 2006 aided by an external specialist. So far all programme and research group leaders have been “educated” in this IMR project procedure, and during autumn 2007 all project leaders will go through the IMR project course.

There were 19 research groups as in the 2004 organisation, some of them were more or less a continuation of the groups established in 2004. But some of the 2004 groups were not re-established, and some groups were new. A fundamental difference from the 2004 groups was that the scientists and research technicians now could be together within the research groups (Fig. 6). The 2004 Research Support Department was transferred to a Technical Infrastructure Department with responsibility for the shore-based facilities of the institute, but with just a few employees.

In the leadership of the institute, there were three new central research director positions, one with responsibility for the strategic development of the institute, one with responsibility for the competence of the scientific staff, and one with the responsibility for the programmes and products of the institute. In addition there were two new regional research director positions with specific responsibility with the units in Tromsø and Arendal.

All positions as head of programmes and research group leaders were advertised internally late 2006 and filled early 2007. The scientific staff was given the option to nominate two groups in prioritised order to belong to, and in most cases the employees were given their first choice. The new central research director positions and leader of technical infrastructure department was advertised widely, and filled June 2007.

The adjusted organisation was made operational late February 2007, and the budgeting of the programmes with the numerous accompanying projects were adopted by the Board in April 2007.

## **External influence**

The organizational development of the institute described so far has been made without much influence of external factors or circumstances. But in 2004, the Norwegian Parliament adopted a white paper, "Development of marine businesses: the Blue Acre" (Anon., 2004a), in which there is made a division between science for management and for business development. A new science enterprise for marine business development, NOFIMA, is envisaged. The Institute of Marine Research is supposed to concentrate its activity towards science for management advice. A committee developed this further in a proposal for the new

marine science enterprise for business development, NOFIMA, by Desember 2004. The committee suggested that scientific activity relevant for business development in the aquaculture sector should be transferred from the Institute of Marine Research to NOFIMA (Anon., 2004b). This has had a influence of the adjustment of organization of the institute in that new research groups and programmes have been established with the main purpose to deliver science and advices for management of our large marine ecosystems and the aquaculture industry. NOFIMA will be formally established from 2008. An evaluation committee has recently concluded that substantial parts of the aquaculture competence within the institute is relevant for marine business development (Anon., 2007), but it is not decided what activity should be transferred from IMR to NOFIMA.

### **Effects on scientific and advisory activity**

The management advice programs were attempted realized with a project portfolio that had a clear ecosystem philosophy. The scientific and advisory activity went on much as before, but at least on a national level more determined attempts were made to take ecosystem information and considerations into account when advising on harvesting on living marine resources, protection of specific habitats and use of Norwegian waters for offshore oil and gas exploration. This development is evident in the report produced by the institute annually on the status of the marine environment, living resources, aquaculture and coastal zone. During the nineties this status reports were produced as three volumes (living resources, marine environment, and aquaculture), but from 2005 they have appeared as two volumes with a clear ecosystem orientation (living resources and marine environment with ecosystem division, aquaculture – coastal zone).

The new way of functioning has had a pronounced effect on the arrangement of the seagoing activity of the institute. There has been a clear development towards ecosystem cruise where basic parameters of the physical environment, plankton biomass, commercially important fish stocks and other central ecosystem parameters are being monitored simultaneously. This development has been most pronounced in the late summer – early autumn cruises in the Barents Sea where basic parameters of the physical environment, benthic fauna and shrimps, plankton biomass, different life stages of commercially important benthic and pelagic fish stocks and whales are being monitored simultaneously (Olsen, 2005). As such the data basis

now provide during the seagoing activity should be better for holistic scientific assessments of our marine ecosystems.

Following the adoption of the white paper “A Clean and Rich Sea” by the Norwegian Parliament in 2002, management plans should be developed for the Norwegian waters starting with the Lofoten – Barents Sea. This process is lead by the Royal Norwegian Ministry of Environment, and the institute have been given a central role in the production of underlying documentation regarding description of the environment and living resources in the area Føyn et al., 2002), definition and description of vulnerable areas (Olsen and Quillfeldt, 2003, Anon, 2005), consequences of fishing, needs for more knowledge (Quillfeldt and Olsen, 2003) and development of ecosystem indicators (Quillfeldt and Dommasnes, 2005). The deliveries requested from the institute were delivered timely and as expected, and the Management plan for the Lofoten – Barents Sea (Anon, 2006) was adopted by the Norwegian parliament in 2006. The institute is given a central role in the following up of the Lofoten – Barents Sea Management plan, among other positions with the leading responsibility for the observation forum. Now, the underlying documentation for a similar Management Plan for the Norwegian Sea is being developed, and the institute has been given a central role. The new organisation enabled an easier formulation of projects that could allocate the necessary effort to realize the deliveries expected from the institute regarding these management plans.

The number of peer review scientific articles increased from 134 in average for the years 2001 – 2003 to 160 for the years 2004 – 2006 (Fig. 7). The total advisory and scientific production (peer review articles, ICES reports, other reports, presentations etc) increased from 820 contributions for the years 2001 – 2003 to 1017 for the years 2004 – 2006. Similarly, the scientifically based advises (we advice on the harvest of about 35 of the 80 fish stocks targeted by Norwegian fishers) on catch quotas of the most important fish stocks and management of the ocean environment of Norwegian waters were at least as well founded and profiled as before. Therefore, it seems that development and implementation of a new organization and way of functioning of the institute in the years 2002 – 2004 did not have a negative effect on the advisory and scientific production of the institute.

Within the Aquaculture programme, there has been a clear shift of focus from projects to enhance the development of the Norwegian aquaculture industry towards projects to provide knowledge for managing the Norwegian aquaculture industry. This is a response to the

expectations from the Blue – Green Food Alliance, and the establishment of the NOFIMA scientific enterprise.

## **Perspective**

Within the new organization and way of functioning of IMR, the science and advisory programs still are in an early phase of development. In the years to come, attention will be given to further refine and develop the ecosystem approach as their central element. An obvious development so far is that the main surveys in the Barents Sea, the Norwegian Sea and the North Sea now have a clear ecosystem focus, including simultaneous monitoring of hydrography, plankton, fish stocks and marine mammals.

The main goal of the development of the organization of the Institute of Marine Research, Norway is to enable better and more reliable ecosystem based advices and to realise science of a higher quality. If those ambitions will be fulfilled is up to us and our co-workers. We believe the 2004 reorganization and 2007 adjustment have been necessary to modernize the institute and to create a more dynamic and integrated organization that shall be able to cope with complicated scientific issues on the condition, production and human impact on marine ecosystem in Norwegian waters. If we succeed or not, will be up to our owner, contractors, users, and the Norwegian society to evaluate.

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## Figure legends

Fig. 1. A framework for ecosystem approach to ocean management with main components or modules shown in an iterative management decision cycle. This is a slightly simplified version of the framework in the Bergen Declaration (NSC 2002). Stakeholders should be included in the process to promote openness and transparency.

Fig. 2. Time schedule for the development of the organization of the Institute of Marine Research, Norway.

Fig. 3. Locations of the Institute of Marine Research, Norway.

Fig. 4. The organisational chart of the Institute of Marine Research, following reorganisation in 2004 to be better adapted to support the ecosystem approach to ocean management.

Fig. 5. The present organisational chart of the Institute of Marine Research, Norway, showing the main departments and the Management and Science programmes.

Fig. 6. The present organisational chart of the Institute of Marine Research, Norway, showing the science groups and different departments.

Fig. 7. The scientific production at The Institute of Marine Research, Norway, for the years 2000 – 2006 (for 2006 the final production numbers are not ready yet, and the 2006 numbers represents the production January 1<sup>st</sup> – September 1<sup>st</sup> only).

Framework for an  
ECOSYSTEM APPROACH  
to Ocean Management













